

Luminescent *Mycena*: new and noteworthy species

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Abstract: Seven species of *Mycena* are reported as luminescent, representing specimens collected in Belize, Brazil, Dominican Republic, Jamaica, Japan (Bonin Islands), Malaysia (Borneo) and Puerto Rico. Four of them represent new species (*Mycena luxaeterna*, *M. luxarboricola*, *M. luxperpetua*, *M. silvaelucens*) and three represent new reports of luminescence in previously described species (*M. aff. abieticola*, *M. aspratilis*, *M. margarita*). *Mycena subepipterygia* is synonymized with *M. margarita*, and *M. chlorinosma* is proposed as a possible synonym. Comprehensive descriptions, illustrations, photographs and comparisons with phenetically similar species are provided. A redescription of *M. chlorophos*, based on analyses of type specimens and recently collected topotypical material, is provided. The addition of these seven new or newly reported luminescent species of *Mycena* brings the total to 71 known bioluminescent species of fungi.

Key words: Agaricales, bioluminescence, Mycenaceae, mycenoid fungi, taxonomy

INTRODUCTION

Sixty-four species of lamellate and poroid basidiomycetous fungi (Agaricales) are currently recognized as bioluminescent (Desjardin et al. 2008), representing four distinct lineages belonging to the Omphalotaceae (*Omphalotus* lineage, 12 spp.), Physalacriaceae (*Armillaria* lineage, five spp.), Mycenaceae (Mycenoid lineages, 45 spp.) and an unnamed lineage (includ-

ing *Gerronema viridilucens* Desjardin, Capelari & Stevani and *Mycena lucentipes* Desjardin, Capelari & Stevani; Perry and Desjardin unpubl). Our continued search for bioluminescent fungi has yielded an additional four new species belonging to genus *Mycena* and three previously published species heretofore unknown as luminescent. These taxa are described formally or redescribed herein. A single specimen from São Paulo state, Brazil, mistakenly reported among collections of *M. fera* Maas Geest. & de Meijer by Desjardin et al. (2008), shows affinities to *M. abieticola* Singer, a species described from Mexico growing on the bark of *Abies religiosa*. We report this specimen as representing a luminescent *Mycena* species and provide a comprehensive description but do not formally describe it as new until additional material becomes available. *Mycena aspratilis* Maas Geest. & de Meijer, described recently from material collected in Paraná, Brazil, and the sole member of sect. *Aspratiles*, is reported herein as luminescent based on new material from Puerto Rico. In addition *M. margarita* (Murr.) Murr., a species widespread in the Caribbean region, is reported for the first time as frequently luminescent, and we recognize *M. subepipterygia* (Murr.) Murr. as a synonym and *M. chlorinosma* Singer as a possible synonym. The binomial *Mycena chlorophos* (Berk. & M.A. Curtis) Sacc., typified by material collected in the 1850s from the Bonin Islands, Japan, has been used for bioluminescent agarics occurring in southern Asia, southeastern Asia, the Pacific, Australia and Brazil. Unfortunately published descriptions of this species that document taxonomically informative features are based on material collected from Sri Lanka, Malaysia, Borneo and Brazil, not from the Bonin Islands. To stabilize the epithet, allow for accurate comparisons of New World and Old World specimens commonly referred to *M. chlorophos* and to help determine whether the species is pantropical or represents several distinct geographically isolated species we provide a comprehensive description derived from topotypical material and designate an epitype specimen. The addition of these seven new or newly reported luminescent *Mycena* species brings the total to 71 known bioluminescent species of fungi.

MATERIALS AND METHODS

Color terms and notations in parentheses in lowercase are those of Korf and Wanscher (1978), while capitalized names are those of Ridgway (1912) as reproduced by

Smithe (1975). The term "inamyloid" means not reactive in Melzer's reagent (neither amyloid nor dextrinoid). We define "pileus marginal cells" as terminal cells of pileipellis hyphae found on the margin of the pileus, often represented macromorphologically as a ciliate pileus margin. All measurements and colors reported for microscopic features were observed from dried material rehydrated in 100% ethanol followed by distilled water, 3% potassium hydroxide (KOH) or Melzer's reagent. Basidiospores were measured in Melzer's reagent after rehydration with 100% ethanol. Spore statistics include: \bar{x}_m , the arithmetic mean of the spore length by spore width (\pm standard deviation) for n spores measured in a single specimen; x_{mr} , the range of spore means, and \bar{x}_{mm} , the mean of spore means (\pm SD) when more than one specimen is available; Q , the quotient of spore length by spore width in any one spore, indicated as a range of variation in n spores measured; Q_m , the mean of Q values in a single specimen; Q_{mr} , the range of Q_m values and Q_{mm} , the mean of Q_m values where more than one specimen is available; n , the number of spores measured per specimen; s , the number of specimens involved. Herbarium acronyms (F, FH, FLAS, LE, NY, SFSU, SP, TFM, TMI, ZT) are from Holmgren et al. (1990). Photographs of luminescing basidiomes were taken with a NIKON D50 digital camera equipped with a Nikkor AF Zoom 28–105 mm lens with exposure 90–120 s or a Nikon D200 digital camera with exposure 480–720 s. We follow the taxonomic constructs of Matheny et al. (2006) at the family rank and Maas Geesteranus (1992, 1997) at the infrageneric rank.

TAXONOMY

Mycena silvaelucens B.A. Perry et Desjardin, sp. nov.
(FIGS. 1, 9)

Mycobank MB 515159

Pileus 4–18 mm diam, forma hemisphaerii, tum plano-convexus vel planus, in centro brunneus et ad marginem cineraceus vel fere candidus; superficies non viscida, non sulcata. Lamellae subdecurrentes, intervenosae, incanae, atrantes vel fumeae, maturentes cum margine palescente. Stipes 4–14 \times 0.5–1 mm, cineraceus, laevis, affixus per album adpressum mycelialem pulvinum. Odor indistinctus; sapor fungoideus. Basidiosporae 7–9.5 \times 5–6.5 μ m, valde amyloideae. Cheilocystidia 27–56 \times 10–17.5 μ m, fusiformes ventricosa, apice rotundato-capitato vel acuminato et elongato, 20 μ m longo et interdum furcato. Pleurocystidia carentia. Pileipellis hyphae sparsim nodulosa, non spinulosa. Pileus et stipes flavovirentem lucem emittentes, stipes magis intense luminescens. Fungi gregarii in cortice dipterocarpacearum arborearum, non montanus in sylvae borneensi. Holotypus hic designatus: Malaysia, Borneo, Sabah, Sepilok, 12 Dec 2007, B.A. Perry 568 (SFSU).

Etymology. *silvae* = forest (L.), *lucens* = light (L.), referring to the light emitted by the forest-dwelling basidiomes.

Pileus (FIG. 1) 4–18 mm diam, hemispherical to broadly convex, soon expanding to convex-applanate or applanate; margin entire, pellucid-striate; surface moist to dry (not viscid), glabrous, when young, disc

dark grayish brown (6D-E3-4) and pale gray toward the margin, in age becoming grayish brown (5C3-4) with a whitish gray margin, hygrophorous, becoming pale gray with nearly white margin with moisture loss. **Context** thin (< 1 mm), concolorous with pileus surface. **Lamellae** subdecurrent, subdistant (12–15) with 1–2 series of lamellulae, narrow, intervenose, grayish white when young, darkening to grayish brown (5C3) with pallid edges in age. **Stipe** 4–14 \times 0.5–1 mm, central in most, slightly eccentric in some, terete, cylindrical or enlarged slightly toward the base, smooth, glabrous, slightly polished, pale grayish white to pale gray overall, arising from a flattened pad of white radiating mycelium. **Odor** not distinctive. **Taste** fungoid.

Luminescence. Pileus, lamellae and stipe emit yellowish green light, stipe more intensely luminescent than the pileus and lamellae; mycelium luminescence undetermined.

Basidiospores (FIG. 9a) (7–)7.5–9.5 \times 5–6.5 μ m [\bar{x}_m = 8.3 \pm 0.6 \times 5.8 \pm 0.5 μ m, Q = 1.3–1.6, Q_m = 1.4 \pm 0.08, n = 25], broadly ellipsoid, smooth, hyaline, strongly amyloid, thin-walled. **Basidia** (FIG. 9b) 21–30 \times 8–9 μ m, clavate, 4-spored, clamped. **Basidioles** clavate. **Lamellar edge** sterile; **cheilocystidia** (FIG. 9c) 27–51 (–56) \times 10–17.5 μ m, fusoid-ventricose, apex constricted or with a short, broad mucro, or with an elongated or forked, irregular projection up to 20 μ m long, hyaline, inamyloid, thin-walled, nongelatinous. **Pleurocystidia** absent. **Subhymenium** nongelatinous. **Lamellar trama** regular, hyphae 6–22 μ m diam, cylindrical to inflated, hyaline, strongly dextrinoid, thin-walled. **Pileipellis** a cutis of loosely interwoven, repent hyphae 2–4 μ m diam, cylindrical to sinuous, branched, smooth or a few with short knob-like branchlets, nonspinulose, nonincrusted, hyaline, weakly dextrinoid, nongelatinous, thin-walled, as a thin tissue layer overlaying the pileus tramal hyphae or slightly interspersed with them; **pileocystidia** absent; **terminal cells** undifferentiated, cylindrical, obtuse. **Hypodermium** undifferentiated from the tramal tissue. **Pileus trama** composed of two types of loosely interwoven hyphae: (i) narrowly cylindrical hyphae 3–8 μ m diam resembling those of the pileipellis; (ii) broad, cylindrical to inflated hyphae 12–24 (–40) μ m diam, hyaline, dextrinoid, smooth or incrusted. **Stipitipellis** a cutis with scattered, erect terminal cells (caulocystidia); **cortical hyphae** 4–8 μ m diam, parallel, cylindrical, smooth (nonspinulose), nonincrusted, hyaline, dextrinoid, nongelatinous, thin-walled; **medullary hyphae** similar but up to 20 μ m diam. **Caulocystidia** scattered, 16–40 \times 2.5–4.5 μ m, cylindrical, smooth, obtuse, hyaline, inamyloid, nongelatinous, thin-walled. **Basal pad** composed of clusters of tightly adherent hyphae 2.5–4 μ m diam, cylindrical, smooth, hyaline, weakly dextrinoid, nongelatinous, thin-walled



FIGS. 1–7. Bioluminescent species of *Mycena*. Daylight (a) and dark (b) exposures. 1. *Mycena silvaelucens* (HOLOTYPE). 2. *Mycena luxaeterna* (HOLOTYPE). 3. *Mycena luxperpetua* (HOLOTYPE). 4. *Mycena aspratilis* (PR-6539). 5. *Mycena luxarboricola* (PARATYPE). 6. *Mycena* aff. *abieticola* (SP 380282). 7. *Mycena margarita* (PR-5447). Bar = 5 mm.

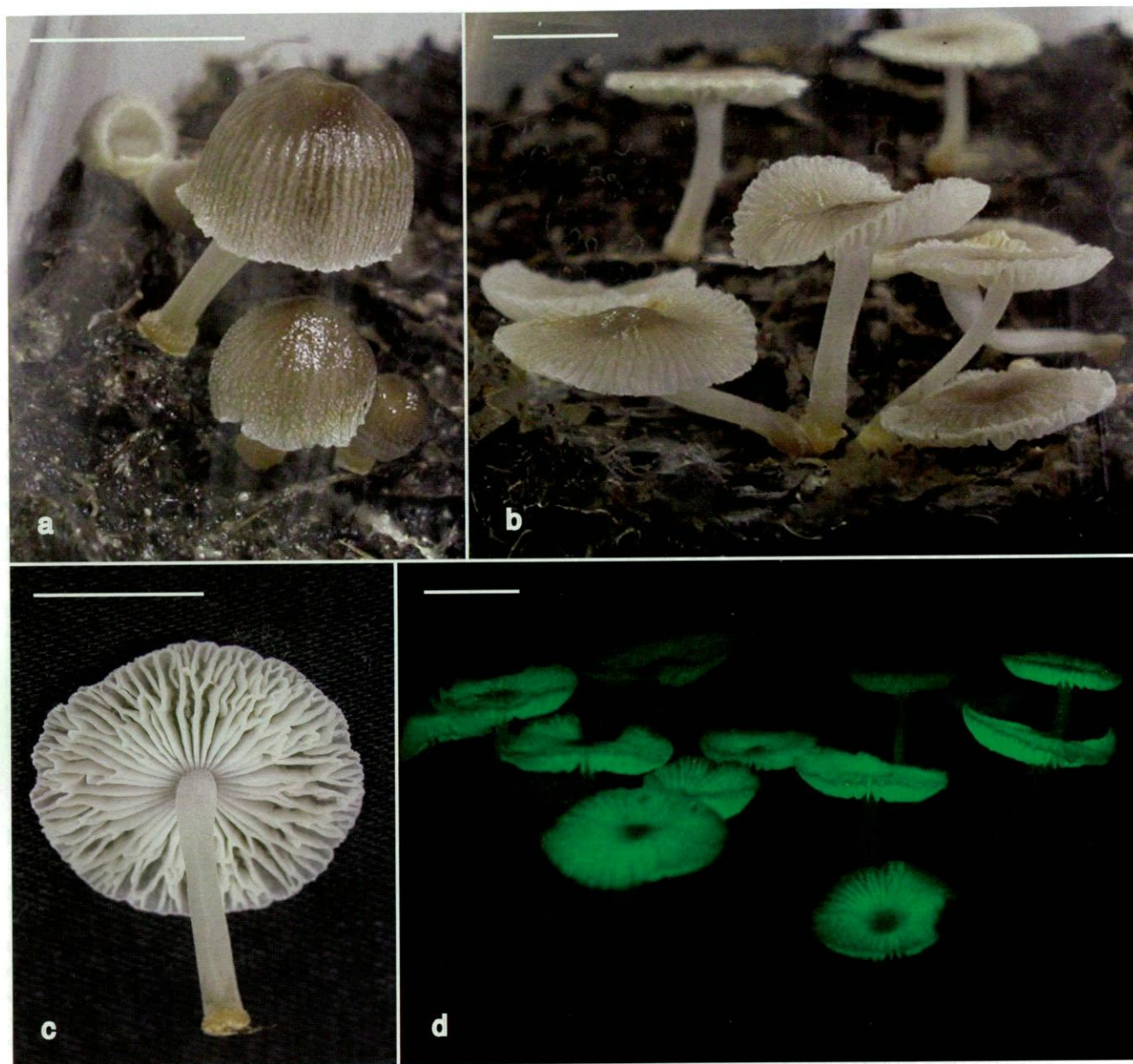


FIG. 8. *Mycena chlorophos* fruited in culture from inoculum isolated from topotypical material (TFM-M-M512). a. Basidiomes formed 9 Nov 2006. b. 13 Nov 2006. c. 18 Dec 2006. d. 13 Nov 2006. Bar = 10 mm.

or with walls up to $0.8\ \mu\text{m}$ thick; terminal cells repent or slightly recurved, like the caulocystidia. *Clamp connections* present in all tissues.

Habit, habitat and known distribution. Gregarious, abundant on bark of standing dipterocarpous tree in lowland dipterocarp forest. Borneo. Known only from the holotype.

Holotype. MALAYSIA. Borneo, Sabah, Sepilok, Sepilok Orang-Utan Rehabilitation Center, Mangrove Trail, N05°51.732', E117°56.948', 12 Dec 2007, collected by B.A. Perry, BAP 568 (SFSU).

Commentary. *Mycena silvaelucens* is characterized by moderate size basidiomes with grayish brown to pale

gray, hygrophanous, dry pilei, subdecurrent, intervenose lamellae, a pallid stipe that arises from a pad of white radiating mycelium, broadly ellipsoid, amyloid basidiospores with mean $8.3 \times 5.8\ \mu\text{m}$, abundant fusoid-ventricose cheilocystidia, a pileipellis and stipitipellis of repent, cylindrical, nonspiny, nongelatinous hyphae, lignicolous habit, and luminescent pileus and stipe. The new species is allied with a small group of species in sect. *Fragilipedes* that have grayish brown pilei, nonnitrous odors, smooth cheilocystidia, and nonspiny, nongelatinous pileipellis and stipitipellis hyphae. *Mycena silvaelucens* is most phenetically similar to two Australian species, *M. illiria* Grgurinovic and *M.*

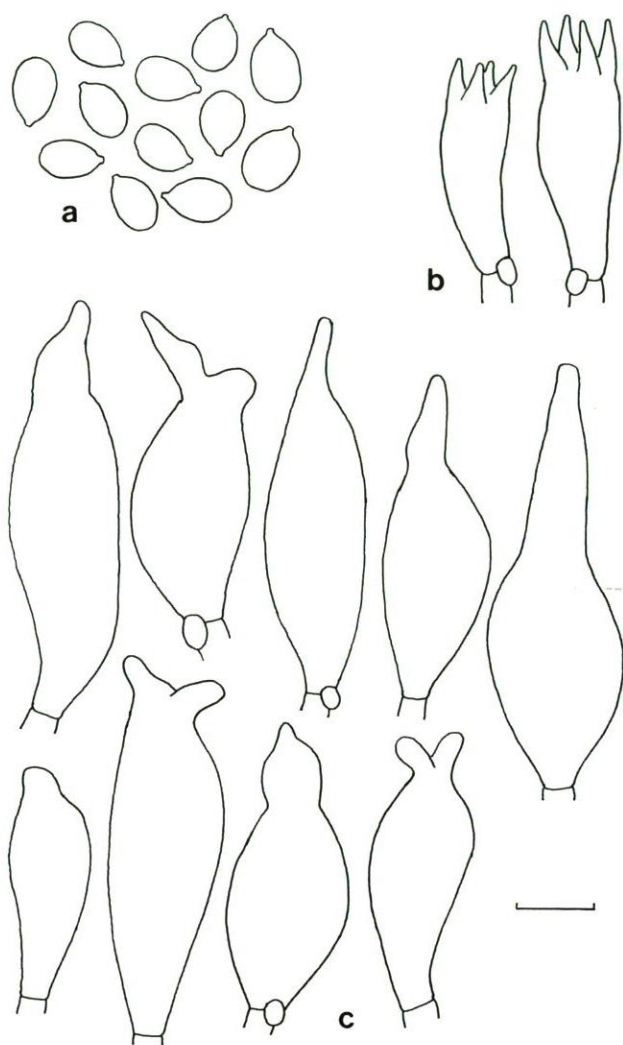


FIG. 9. *Mycena silvaehucens* (BAP 568 – HOLOTYPE). a. Basidiospores. b. Basidia. c. Cheilocystidia. Bar = 10 μ m.

australiana Cleland. *Mycena illiria* differs in forming a broadly conical to umbonate, dark brown to nearly black pileus, adnexed and nonintervenose lamellae, smaller cheilocystidia (mean $32 \times 8.4 \mu\text{m}$), stipitipellis hyphae with nodulose excrescences, and habit on litter (Grgurinovic 2002). *Mycena australiana* differs in forming a conico-campanulate, wood brown pileus, adnate and nonintervenose lamellae, a mealy stipe base lacking radiating mycelium, narrower cheilocystidia (mean width $8.3 \mu\text{m}$), and stipitipellis hyphae with nodulose excrescences (Grgurinovic 2002). Neither of these Australian species was reported as luminescent.

Mycena luxaeterna Desjardin, B.A. Perry et Stevani, sp. nov. (FIGS. 2, 10)

Mycobank MB 515160

Pileus 4–8(–17) μm diam, plano-convexus, umbilicatus, pellucidus et sulcato-striatus, viscidus; fuscus juventute cum

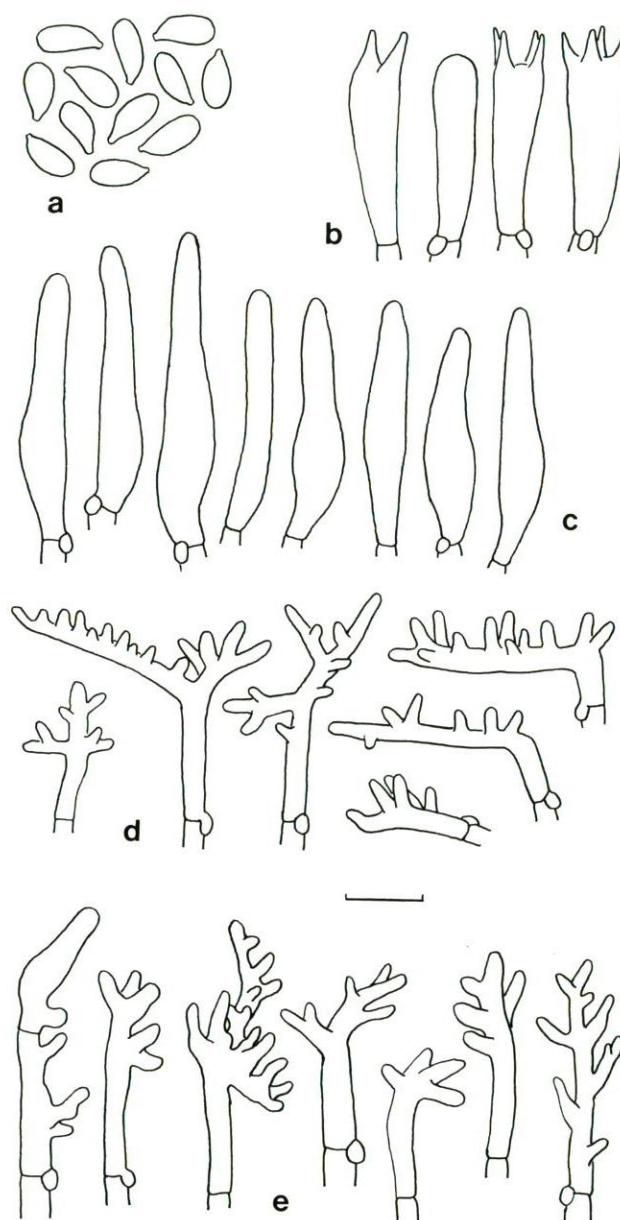


FIG. 10. *Mycena luxaeterna* (DED 8087 – HOLOTYPE). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Bar = 10 μm .

margine candida, postea albo-helvola. Lamellae horizontales, juventute adnatae vel subdecurrentes, postea magis decurrentes, subdistantes, incanae, margine in vivo concolori, in sicco aurantiaco et resinoso. Stipes 15–45 \times 1–2 mm, albus, glutinosus, affixus ad ligneum frustum vel coriaceum folium per radiatum album mycelialem pulvinum. Odor leniter raphanoideus; sapor leviter amarus vel raphanoideus. Basidiosporae $6.5\text{--}8.3 \times 3.2\text{--}4.0 \mu\text{m}$, valde amyloideae. Cheilocystidia $27\text{--}45 \times 5.4\text{--}7.5$, subcylindracea, subfusiformes vel anguste fusiformes ventricosa; apex obtusus cum adhaerenti aureo exsudato. Pleurocystidia carentia. Pileipellis ixotrichodermium 80–120 μm crassum, partibus terminalibus dense diverticulatis cum cylindraceis

vel obtusis interdum furcatis projecturis. Stipes flavovirentem validam lucem emittens. Fungi dense gregarii in ramunculo vel raro folio arborearum in silva atlantica, provincia brasiliense Sancti Pauli. Holotypus hic designatus: Brazil, São Paulo state, Mun. Iporanga, Parque Estadual Turístico do Alto Ribeira, 19 Mar 2007, collected by C.V. Stevani, D.E. Desjardin 8087 (SP 381953).

Etymology. *lux* = light (L.), *aeterna* = eternal (L.), referring to the constant light emitted by the basidiomes. The epithet was inspired by and borrowed from Mozart's Requiem (Communio).

Pileus (FIG. 2) 4–8(–17) mm diam, convex to plano-convex with a central umbilicus, striate to sulcate, glabrous, viscid, shiny; when young dark grayish brown (6F4-5), fading with age to grayish yellow (5D3-4) or pale grayish brown (6D3), with a pale grayish white ring at the edge. *Lamellae* horizontal, adnate to subdecurrent when young, subdecurrent to decurrent in age, subdistant (13–18) with two series of lamellulae, pale grayish white, nonmarginate when fresh, edges orange and resinous in dried material. *Stipe* 15–30(–45) × 1–1.5(–2) mm, central, terete, cylindrical, equal, hollow, pliant to subcartilaginous, arising from white radiating basal mycelium, white to translucent-hyaline and coated overall with a thick, clear gel. *Odor* weakly raphanoid. *Taste* slightly bitter or raphanoid.

Luminescence. Stipe strongly yellowish green luminescent, strongest near the base; elsewhere nonluminescent. Mycelium luminescent in culture.

Basidiospores (FIG. 10a) 6.5–8.3 × 3.2–4.0 µm [$x_{mr} = 6.8-7.5 \times 3.5 \mu m$, $x_{mm} = 7.2 \pm 0.5 \times 3.5 \pm 0.04 \mu m$, $Q = 1.9-2.3$, $Q_{mr} = 2.0-2.1$, $Q_{mm} = 2.05 \pm 0.1$, $n = 16-22$, $s = 2$], ellipsoid to amygdaliform, smooth, hyaline, strongly amyloid, thin-walled. *Basidia* (FIG. 10b) 22–25 × 6.4–7.0 µm, clavate, hyaline, 4-spored, rarely 2-spored, clamped. *Basidioles* clavate, hyaline. *Lamellar edge* sterile, golden orange in water and 3% KOH from a coating of plaque-like resinous exudates; *cheilocystidia* (FIG. 10c) abundant, 27–45 × 5.4–7.5 µm, subcylindrical to subfusoid or narrowly fusoid-ventricose, obtuse, hyaline, inamyloid, nongelatinous, thin-walled. *Pleurocystidia* absent. *Subhymenium* nongelatinous. *Lamellar trama* regular, composed of subparallel hyphae 2.5–12 µm diam, cylindrical, hyaline, dextrinoid, nongelatinous, thin-walled. *Pileipellis* an ixotrichodermium 85–120 µm thick, composed of erect, subparallel to interwoven hyphae with diverticulate terminal cells; hyphae 1.5–8 µm diam, cylindrical to slightly irregular in outline, smooth, hyaline, inamyloid, thin-walled, embedded in a gelatinous matrix; *terminal cells* (FIG. 10d) erect to repent, densely diverticulate, 1.5–5 µm diam; diverticula 1.5–6.5 × 1.2–2.2 µm, cylindrical, obtuse, simple or forked, hyaline, inamyloid, thin-walled.

Hypodermium undifferentiated. *Pileus trama* interwoven, composed of hyphae 2–7 µm diam, irregular in outline, hyaline, strongly dextrinoid, nongelatinous, thin-walled. *Stipitipellis* an ixocutis composed of repent, parallel hyphae and caulocystidia embedded in a thick gelatinous matrix; *cortical hyphae* 2–5 µm diam, cylindrical, smooth or with scattered diverticula, hyaline, inamyloid, thin-walled; *medullary hyphae* 3–16(–20) µm diam, cylindrical, smooth, hyaline, strongly dextrinoid, nongelatinous, thin-walled; *caulocystidia* (FIG. 10e) scattered, 18–26 × 2.5–6 µm, simple, cylindrical to subfusoid, obtuse, or irregular in outline and diverticulate like the pileipellis terminal cells. *Clamp connections* common in all tissues.

Habit, habitat and known distribution. Densely gregarious, in clusters of 2–20 basidiomes, mostly on sticks, rarely on leaves of undetermined dicotyledonous trees in primary Atlantic Forest habitat. São Paulo state, Brazil. Known only from a single site.

Holotype. BRAZIL. São Paulo state, Mun. Iporanga, Parque Estadual Turístico do Alto Ribeira, Poço da Viúva, S24°35.220', W48°37.840', 19 Mar 2007, collected by C.V. Stevani, D.E. Desjardin 8087 (SP 381953; Isotype: SFSU).

Paratype. BRAZIL. São Paulo state, Mun. Iporanga, Parque Estadual Turístico do Alto Ribeira, Poço da Viúva, S24°35.220', W48°37.840', 23 Feb 2007, C.V. Stevani 2-23-07 (SP 381962, SFSU).

Commentary. Distinctive features of *Mycena luxaeterna* include: a small, plano-convex, umbilicate, viscid, grayish brown to grayish yellow pileus; subdecurrent, pallid lamellae that develop orange-resinous edges when dried; a translucent, white, thickly gelatinous stipe that strongly emits yellowish green light when observed in the dark; a lignicolous habit on small sticks; strongly amyloid, moderate size basidiospores; narrowly fusoid, obtuse cheilocystidia and a lack of pleurocystidia; nongelatinous subhymenium; a thick ixotrichodermium pileipellis with diverticulate terminal cells that is not readily separable when fresh; no differentiated hypodermium; strongly dextrinoid tramal tissues; a thin ixocutis stipitipellis embedded in a thick gelatinous matrix that is not readily separable when fresh; and caulocystidia similar in morphology to the cheilocystidia and the pileipellis terminal cells.

In the field *M. luxaeterna* is strongly reminiscent of *Roridomyces* (*Mycena*) *roridus* (Scop.) Rexer; however the hymeniform pileipellis of the latter removes *Roridomyces* from consideration. The thick ixotrichodermium-type pileipellis of *M. luxaeterna* is similar to those of members of sect. *Hygrocyboideae* (Fr.) Sing. (e.g. *M. epipterygia* [Scop.:Fr.] S.F. Gray and allies). In the latter species however the pileipellis is readily separable and the lamellae edges are separable as an

elastic thread formed from clavate, apically diverticulate cheilocystidia embedded in a gelatinous matrix. If one overlooks the thick ixotrichodermium pileipellis and thick layer of gelatin on the stipe surface *M. luxaeterna* shares many similarities with members of sect. *Insignes* Maas Geest., such as *M. pseudoclavicularis* A.H. Sm. from Oregon and *M. roriduliformis* (Murr.) Dennis from Jamaica. *Mycena pseudoclavicularis* differs in forming a lubricous (not gelatinous) stipe with densely diverticulate cortical hyphae, larger basidiospores ($8.1\text{--}9.8 \times 4.5\text{--}5.6 \mu\text{m}$), broader cheilocystidia ($6.5\text{--}10 \mu\text{m}$), has pleurocystidia, and grows on debris of yellow pines (Maas Geesteranus 1992). *Mycena roriduliformis* differs in forming a lubricous (not gelatinous) stipe, smaller basidiospores ($4.5\text{--}4.9 \times 2.5\text{--}3.0 \mu\text{m}$), fusiform to subclavate cheilocystidia $7\text{--}17 \mu\text{m}$ diam that are often apically lobed, and a cutis-type pileipellis (Maas Geesteranus 1992). Finally *M. luxaeterna* shares many features with members of sect. *Euspeireae* Maas Geest., although *M. luxaeterna* lacks a gelatinous subhymenium, lacks pleurocystidia and lacks separable pileus and stipe pellicles. Within sect. *Euspeireae* the most phenetically similar species is *M. euspeirea* (Berk. & M.A. Curtis) Sacc. known currently from Cuba, Honduras and Venezuela. *Mycena euspeirea* differs in having a pileus and stipe with separable pellicles, smaller basidiospores ($5.8\text{--}6.1 \times 2.7\text{--}2.9 \mu\text{m}$), broader cheilocystidia ($9\text{--}10 \mu\text{m}$), distinct pleurocystidia, a gelatinous subhymenium and smooth pileipellis hyphae (Maas Geesteranus 1992). Four new species belonging to sects. *Insignes* (viz. *M. conspersa* Maas Geest. & de Meijer, *M. demissa* Maas Geest. & de Meijer, *M. surculosa* Maas Geest. & de Meijer) and *Euspeireae* (*M. tapeina* Maas Geest. & de Meijer) recently were described from the southern state of Paraná, adjacent to São Paulo state (Maas Geesteranus and de Meijer 1997). All four species differ from *M. luxaeterna* in pileipellis and stipitipellis anatomy, cheilocystidia shape, basidiospore size, and lamellar spacing. None of the above mentioned species that are phenetically similar to *M. luxaeterna* have been reported as luminescent. Because *M. luxaeterna* shares features with members of sects. *Hygrocyboideae*, *Insignes* and *Euspeireae* placement in any currently accepted infrageneric taxon is problematical. Multiple gene sequences should help clarify this issue (to be published elsewhere).

Mycena luxperpetua Desjardin, B.A. Perry et Lodge,
sp. nov. (FIGS. 3, 11)

Mycobank MB 515161

Pileus 2–5.5 mm diam, juventute forma hemisphaerii, plano-convexus, postea centro leviter indentato, pellucidostriatus vel subsulcatus, subviscidus, juventute stramineus tinctus, postea ochraceus. Lamellae arcuato-decurrentes,

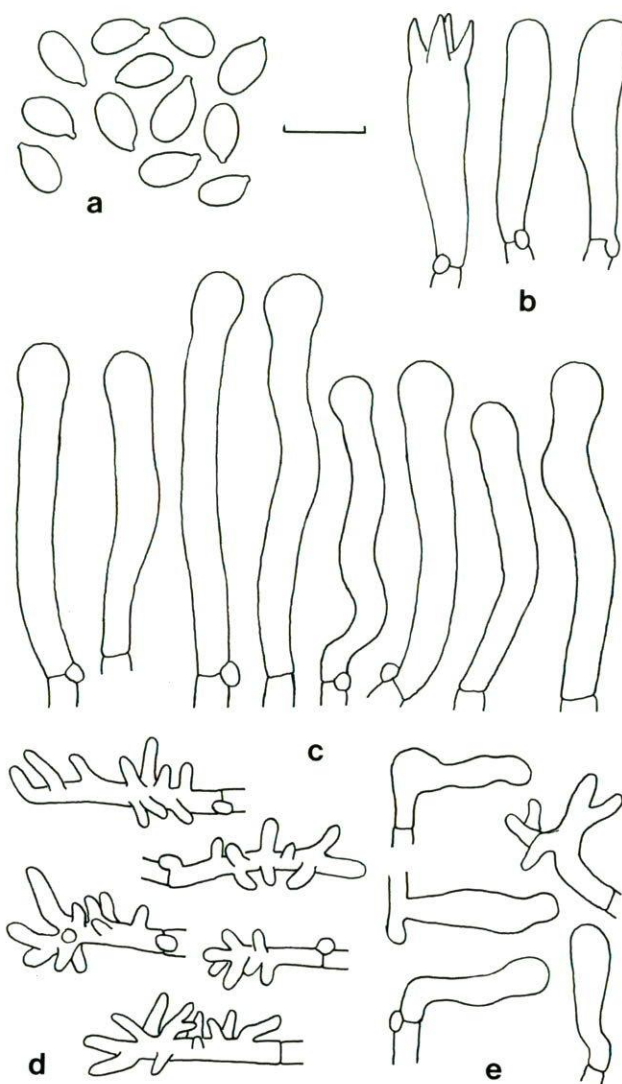


FIG. 11. *Mycena luxperpetua* (PR-6463 – HOLOTYPE). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Bar = 10 μm .

distantes, albae, postea cremeae, margine concolori. Stipes $4\text{--}8 \times 0.5 \text{ mm}$, subviscidus, luteus vel pallidior, postea ochraceus. Basidiosporae $7\text{--}8(8.7) \times 4\text{--}5.5(5.8) \mu\text{m}$, amyloideae. Cheilocystidia abundantis, $38\text{--}52 \times 3.8\text{--}5.5 \mu\text{m}$, cylindracea vel subcylindracea, late obtusa; capitula plerumque subcapitata; cheilocystidia similia pleurocystidiorum. Pileipellis ixocutiformis vel ixotrichodermiformis vel $200 \mu\text{m}$ crassa cum cellulis terminalibus dense diverticulatis; hypodermium constatum e late inflatis hyphis $10\text{--}30 \mu\text{m}$ diam, fusiformibus vel subglobosis, contento hyalino vel spadiceo; trama et subhymenium valde dextrinoidea, non gelatinosa. Stipitipellis ixocutis constata e laevibus vel sparsim diverticulatis hyphis. In cultura totus fungus flavovirentem lucem emittens. Fungi dispersi in erectis mortuis arboribus in silva subtropica humida portoricensis. Holotypus hic designatus: Puerto Rico, El Verde research area, 15 Jan 2007, D.J. Lodge and M. Richardson PR-6463 (SFSU).

Etymology. *lux* = light (L.), *perpetua* = perpetual (L.), referring to the constant light emitted by the basidiomes. The epithet was inspired by and borrowed from Mozart's Requiem (Communio).

Pileus (FIG. 3) 2–5.5 mm diam, convex to hemispherical when young, becoming broadly convex and shallowly depressed in age, pellicid-striate to striate or subsulcate, glabrous, shiny, slightly viscid; Drab Gray with Straw Yellow tints when young, becoming Yellow Ocher to Clay Color in age. *Lamellae* arcuate-decurrent, distant with one series of lamellulae, moderately broad (0.5–0.8 mm), white to Cream Color, nonmarginate, drying white with concolorous edges. *Stipe* 4–8 × 0.3–0.7 mm, central, cylindrical or slightly expanded at the apex and base, apex pruinose, glabrous elsewhere, shiny, slightly to moderately viscid, white to Spectrum Yellow when young, becoming Yellow Ocher to Clay Color in age especially near the base, attached by a hyaline mycelial pad. *Odor* and *taste* not recorded.

Luminescence. yellowish green in all parts of the basidiome and mycelium in culture.

Basidiospores (FIG. 11a) 7–8(–8.7) × 4–5.5(–5.8) μm [$x_m = 7.6 \pm 0.7 \times 4.7 \pm 0.5 \mu\text{m}$, $Q = 1.1$ –1.9, $Q_m = 1.8 \pm 0.1$, $n = 25$], ellipsoid, smooth, hyaline, amyloid, thin-walled. *Basidia* (FIG. 11b) (20–)27–32 × 6–8.5 μm , clavate, 4-spored, rarely 2-spored, with sterigmata up to 7 μm long, clamped. *Basidioles* clavate. *Lamellar edge* mostly sterile, with scattered basidia, nongelatinized; *cheilocystidia* (FIG. 11c) abundant, 38–52 × 3.8–5.5 μm , cylindrical to subcylindrical, broadly obtuse and mostly subcapitate, capitulum 5.5–7.5 μm diam, hyaline, inamyloid, slightly refractive, nonexudative. *Pleurocystidia* scattered, similar to cheilocystidia in shape and size. *Subhymenium* nongelatinous. *Lamellar trama* regular, composed of subparallel hyphae 4.5–13 μm diam, cylindrical to inflated, hyaline, dextrinoid, nongelatinous, thin-walled. *Pileipellis* an ixocutis to an isolattice up to 200 μm thick, composed of subparallel and mostly repent or slightly interwoven hyphae with diverticulate terminal cells; hyphae 1.5–4 μm diam, cylindrical, branched, smooth, hyaline, inamyloid, thin-walled, embedded in a gelatinous matrix; *terminal cells* (FIG. 11d) repent, densely diverticulate, 1.5–3.2 μm diam; diverticula 1.5–8 × 0.5–2 μm , cylindrical, obtuse, simple or forked, hyaline, inamyloid, thin-walled. *Hypodermium* composed of broadly swollen hyphae 10–30 μm diam, fusoid to subglobose, contents hyaline to pale grayish brown, dextrinoid, nongelatinous to subgelatinous, thin-walled. *Pileus trama* interwoven, composed of hyphae 5–16 μm diam, cylindrical to inflated, hyaline, strongly dextrinoid, nongelatinous, thin-walled. *Stipitipellis* an ixocutis composed of repent, parallel hyphae and

caulocystidia; *cortical hyphae* 3–8 μm diam, cylindrical, smooth or with scattered diverticula, hyaline, inamyloid, gelatinous, thin-walled; *medullary hyphae* 5.5–20 μm diam, cylindrical or sometimes inflated, hyaline, strongly dextrinoid, nongelatinous, thin-walled; *caulocystidia* (FIG. 11e) scattered, 16–24 × 3.2–5.5 μm , simple, clavate, obtuse, or a few irregular in outline and diverticulate like the pileipellis terminal cells. *Clamp connections* common in all tissues, some of the medallion-type in the pileus isolattice.

Habit, habitat and known distribution. Lignicolous, scattered on standing dead undetermined dicotyledonous tree. Puerto Rico. Known only from the holotype.

Holotype. PUERTO RICO. El Verde research area, almost to the ridge above footbridge over the Q. Sonadora, N18°19'24", W65°49'25", 360 m, 15 Jan 2007, collected by D.J. Lodge and M. Richardson, PR-6463 (SFSU).

Commentary. Distinctive features of *Mycena luxperpetua* include: a small, convex-depressed, viscid, Drab Gray to Clay Color pileus; arcuate-decurrent, pallid, nonmarginate lamellae; a latently ochraceous to Clay Color, viscid (not thickly gelatinous) stipe; entirely luminescent basidiomes; broadly ellipsoid basidiospores; cylindrical, subcapitate cheilocystidia and pleurocystidia; nongelatinous subhymenium; an ixocutis pileipellis with diverticulate terminal cells that might represent a separable pellicle; a differentiated hypodermium of fusoid to subglobose cells often with grayish brown contents; strongly dextrinoid tramal tissues; a thin ixocutis stipitipellis of weakly gelatinized hyphae; and caulocystidia similar in morphology to the cheilocystidia and the pileipellis terminal cells. Mycelial cultures are strongly luminescent (FIG. 1a, as *Mycena* aff. *euspeirea*, Desjardin et al. 2008).

Many features of *M. luxperpetua* are similar to those of *M. luxaeterna*, and in the field they would be nearly indistinguishable except for size. *Mycena luxaeterna* however differs in forming larger basidiomes (pileus 4–17 mm diam; stipe 15–45 × 1–2 mm), lamellar edges with orange resinous exudates when dried, a white (non-yellow) stipe covered with a thick hyaline gel, basidiospores with mean range 6.8–7.5 × 3.5 μm ($Q_{mm} = 2.0$), fusoid-ventricose cheilocystidia, an absence of pleurocystidia, and no differentiated hypodermium. In comparison *M. luxperpetua* forms smaller basidiomes (pileus 2–5.5 mm diam; stipe 4–8 × 0.3–0.7 mm), lamellar edges lacking orange resinous exudates, a yellow stipe that is merely viscid (not glutinous), broader basidiospores with mean 7.6 × 4.7 μm ($Q_m = 1.8$), cylindrical-subcapitate cheilocystidia and pleurocystidia, and a differentiated hypodermium. As with *M. luxaeterna*, *M. luxperpetua* shares some features with members of sects. *Insignes*

and *Euspeireae* but differs from all described species by the unique combination of characters itemized above.

Mycena luxarboricola Desjardin, B.A. Perry et Stevani, sp. nov. (FIGS. 5, 12)

MycoBank MB 515162

Pileus 3–5 mm diam, convexus vel obtuse conicus, striatus, glaber, cum disco spadiceo vel ochraceo, margine alutaceo vel albido. Lamellae arcuatae, subdistantes, modice latae, albae vel alutaceae, non-marginatae. Stipes 8–12 × 0.75–1 mm, ad centrum, cylindraceus, siccus, ubique pruinosis, basi fibrillis albis; apex albus vel alutaceus; basis ochracea vel spadicea. Basidiosporae 7–10.2 × 7–9.3 µm, amyloideae. Cheilocystidia abundantia, 22–38(–52) × (5–) 7–17 µm, subcylindracea vel late clavata, dense spinulosa in dimidio distale; spinulae 1.5–3.5 × 0.5–1.5 µm, cylindraceae vel bacilliformes. Pleurocystidia carentes. Pileipellis cutis constata e dense spinulosis hyphis 3–13 µm diam, hyalina vel cum brunneo globulari contento, non-amyloidea, non-gelatina; spinulae 1.5–4(–6) × 0.5–1.5 µm, cylindraceae vel bacilliformes; hypodermium constatum e hyphis inflatis < vel = to 25 µm diam, valde dextrinoideum, non-gelatinosum. Stipitipellis cutis constata e dense spinulosis hyphis et dispersis caulocystidiis subcylindraceis vel clavatis, similibus cheilocystidiis. Totum basidiome claram flavovirentem lucem emittens. Fungi gregarii in cortice viventium arborum in silva riparia in provincia brasiliense Paranae. Holotypus hic designatus: Brazil, Paraná state, Mun. Jacarezinho, between Fazenda São João and Fazenda Califórnia, 27 Dec 2005, Luiz Fernando Mendes s.n. (SP 380286).

Etymology. *lux* = light (L.), *arboricola* = dwelling in a tree (L.), referring to the luminescent arboreal basidiomes.

Pileus (FIG. 5) 3–5 mm diam, convex to obtusely conical, striate, dull, dry, glabrous, disc pale brown to ochraceous, margin pale yellowish white to nearly white. **Lamellae** arcuate, subdistant (8–10) with one series of lamellulae, moderately broad, white to pale yellowish white, nonmarginate. **Stipe** 8–12 × 0.75–1 mm, central, terete, cylindrical, pliant, hollow, dull, dry, pruinose overall, base with white fibrils; apex white to pale yellowish white, base ochraceous to pale brown. **Odor and taste** not recorded.

Luminescence. Entire basidiome emits bright yellowish green light.

Basidiospores (FIG. 12a) 7–10.2 × 7–9.3 [$x_{mr} = 8.5 \times 7.8$ –8.2 µm, $x_{mm} = 8.5 \pm 0.0 \times 8.0 \pm 0.3$ µm, $Q = 1.0$ –1.2, $Q_{mr} = 1.03$ –1.08, $Q_{mm} = 1.05 \pm 0.03$, $n = 20$, $s = 2$], globose to subglobose, smooth, hyaline, strongly amyloid, thin-walled. **Basidia** (FIG. 12b) 22–28 × 8.3–10 µm, clavate to broadly clavate, hyaline, 4-spored, clamped. **Basidioles** clavate. **Cheilocystidia** (FIG. 12c) abundant, lamellar edge sterile, 22–38 (–52) × (5–) 7–17 µm, subcylindrical to broadly

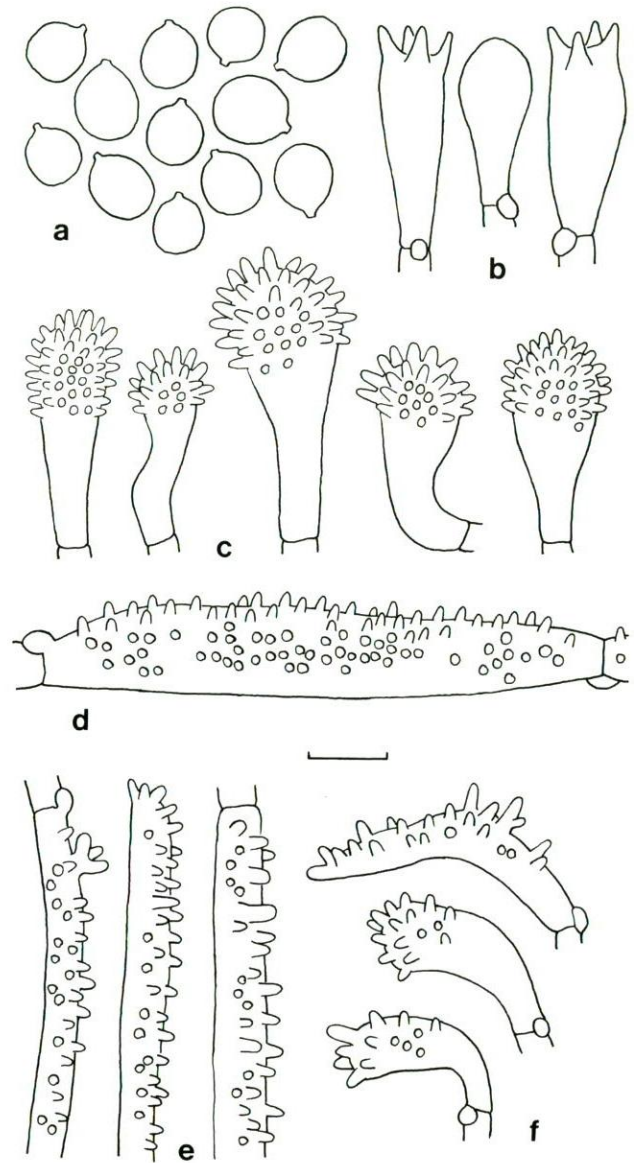


FIG. 12. *Mycena luxarboricola* (SP 380286 – HOLOTYPE). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis hyphae. e. Stipitipellis hyphae. f. Caulocystidia. Bar = 10 µm.

clavate, densely spinulose over the upper half, hyaline, inamyloid, nongelatinous, thin-walled; spinulae 1.5–3.5 × 0.5–1.5 µm, cylindrical to rod-like, obtuse, hyaline, thin-walled. **Pleurocystidia** absent. **Subhymenium** nongelatinous. **Lamellar trama** regular, of dextrinoid hyphae. **Pileipellis** a cutis of repent, densely spinulose hyphae (FIG. 12d); hyphae 3–13 µm diam, cylindrical to inflated, hyaline or with brown globular contents, inamyloid, nongelatinous, thin-walled; spinulae 1.5–4(–6) × 0.5–1.5 µm, cylindrical to rod-like, obtuse, hyaline. **Hypodermium** pseudoparenchymatous, composed of short, inflated hyphae up to 25 µm diam, hyaline, strongly dextrinoid, non-

gelatinous, thin-walled. *Pileus trama* hyphae interwoven, cylindrical, nongelatinous to subgelatinous, dextrinoid. *Stipitipellis* a cutis of repent, densely spinulose hyphae plus scattered caulocystidia; *stipitipellis hyphae* (FIG. 12e) (2–)5–10 μm diam, cylindrical to slightly inflated, hyaline, inamyloid, nongelatinous, thin-walled, covered with spinulae $1.5\text{--}3.2 \times 0.5\text{--}1.5 \mu\text{m}$, cylindrical to rod-like; *cortical hyphae* 2.5–4 μm diam, parallel, cylindrical, smooth, hyaline, strongly dextrinoid, nongelatinous, thin-walled; *medullary hyphae* 6–12 μm diam, cylindrical, parallel, hyaline, dextrinoid, nongelatinous, thin-walled; *caulocystidia* (terminal cells, FIG. 12f) scattered, subcylindrical to clavate, similar to the cheilocystidia. *Clamp connections* common in all tissues.

Habit, habitat and known distribution. Solitary, scattered to gregarious on bark of standing, living tree in a riparian forest. Paraná, Brazil. Known only from two specimens within a small area.

Holotype. BRAZIL. Paraná state, Mun. Jacarezinho, between Fazenda São João and Fazenda Califórnia, 27 Dec 2005, collected by Luiz Fernando Mendes s.n. (SP 380286).

Paratype. BRAZIL. Paraná state, Mun. Jacarezinho, São João, Fazenda Califórnia, 20 Dec 2006, collected by Luiz Fernando Mendes s.n. (SP 381961, SFSU).

Commentary. Distinctive features of *Mycena luxarboricola* include: a small, pale brown to ochraceous, dry pileus; arcuate, pallid, nonmarginate lamellae; a small, dry, pruinose stipe; lignicolous basidiomes that are entirely luminescent and grow on the bark of living trees; globose to subglobose, strongly amyloid basidiospores with mean $8.5 \times 8.0 \mu\text{m}$; broadly clavate, densely spinulose cheilocystidia; an absence of pleurocystidia; nongelatinous, cutis-type pileipellis and stipitipellis of densely spinulose hyphae; and dextrinoid, clamped tramal tissues. In combination these features indicate placement in sect. *Supinae*, where it is allied with *M. fera* Maas Geest. & de Meijer, *M. globulisporea* Maas Geest. & de Meijer, and *M. recessa* Maas Geest. & de Meijer, all described recently from the Brazilian state of Paraná. *Mycena fera* differs in forming larger basidiospores (mean $10.5 \times 10.2 \mu\text{m}$), cheilocystidia with fewer (only 3–6) and longer diverticulae ($5\text{--}24 \times 2.5\text{--}10 \mu\text{m}$), and lacks caulocystidia (Maas Geesteranus and de Meijer 1997, Desjardin et al. 2007). *Mycena globulisporea* differs in forming a dark grayish brown pileus, white stipe, larger basidiospores $9.8\text{--}10.7 \times 8.9\text{--}10.3 \mu\text{m}$, cheilocystidia with few apical spinulae, sparse pleurocystidia, and pileipellis and stipitipellis hyphae covered with few, relatively long and coarse diverticulae (Maas Geesteranus and de Meijer 1997). *Mycena recessa* differs in forming a stipe only up to 3 mm long, smaller basidiospores $6.3\text{--}7.2 \times 4.6\text{--}$

$5.5 \mu\text{m}$, cheilocystidia with few apical spinulae, smooth stipitipellis hyphae, and growth on bamboo twigs (Maas Geesteranus and de Meijer 1997).

Singer (1969, 1973) described two species from South America and one from Mexico referable to sect. *Supinae*, and they differ from *M. luxarboricola* as follows. *Mycena hysizyga* Singer, from Argentina, differs in forming a stipe 4–5 mm long, larger basidiospores $9.5\text{--}13 \times 8\text{--}11 \mu\text{m}$, bisporic basidia, narrower cheilocystidia ($3\text{--}7.5 \mu\text{m}$ diam), and lacks clamp connections (Singer 1969). *Mycena melinocephala* Singer also from Argentina differs in forming a yellow, umbilicate pileus, more subglobose to broadly ellipsoid basidiospores $9\text{--}10.5 \times 7\text{--}9.5 \mu\text{m}$, and pileipellis hyphae with longer diverticulae ($< 10 \mu\text{m}$ long) (Singer 1973). *Mycena abieticola*, from Mexico, differs in forming ascending and broadly adnate lamellae, larger basidiospores $10.5\text{--}13.5 \times 8.5\text{--}12 \mu\text{m}$, apparently 2-spored basidia lacking clamp connections, cheilocystidia with longer diverticulae ($< 12 \mu\text{m}$ long), predominantly unclamped hyphae, and grows on conifers (*Abies religiosa*) (Singer 1973). Of the known European and North American species of sect. *Supinae*, *M. luxarboricola* comes closest to *M. supina* (Fr.) Kummer. *Mycena supina* however differs in forming dark brown to dark sepia pilei, more numerous lamellae (11–17) and more densely pruinose stipes with abundant caulocystidia (Maas Geesteranus 1992, Robich 2003). Of the above mentioned phenetically similar species only *M. fera* has been reported as luminescent (Desjardin et al. 2007).

Mycena aff. *abieticola* Singer, Beih. Sydowia 7:37. 1973. (FIGS. 6, 13)

Pileus (FIG. 6) about 5 mm diam, obtusely conical, striate, dull, dry, glabrous to minutely pruinose, pale yellowish brown. *Lamellae* adnate with a decurrent tooth to arcuate, distant, broad, white, nonmarginate. *Stipe* about $10 \times 0.5 \text{ mm}$, terete, cylindrical, dull, dry, glabrous, apex pale yellowish brown, base brown, noninstitious, arising from white tomentum. *Odor* and *taste* not recorded.

Luminescence. Entire basidiome emitting a bright, greenish-yellow light.

Basidiospores (FIG. 13a) $10.2\text{--}14 \times (9.5\text{--})10.2\text{--}13 \mu\text{m}$ [$x_m = 12.5 \pm 1.1 \times 11.8 \pm 1.0 \mu\text{m}$, $Q = 1.0\text{--}1.2$, $Q_m = 1.05 \pm 0.05$, $n = 25$], subglobose to globose, smooth, hyaline, amyloid, thin-walled. *Basidia* (FIG. 13b) $20\text{--}26 \times 11.2\text{--}13.2 \mu\text{m}$, broadly clavate, hyaline, thin-walled, 2-spored with sterigmata up to $9.5 \mu\text{m}$ long, unclamped. *Basidioles* broadly clavate. *Cheilocystidia* (FIG. 13c) abundant, $24\text{--}30 \times 6.5\text{--}8.5 \mu\text{m}$, subcylindrical to clavate, with few apical spinulae, hyaline, inamyloid, nongelatinous, thin-

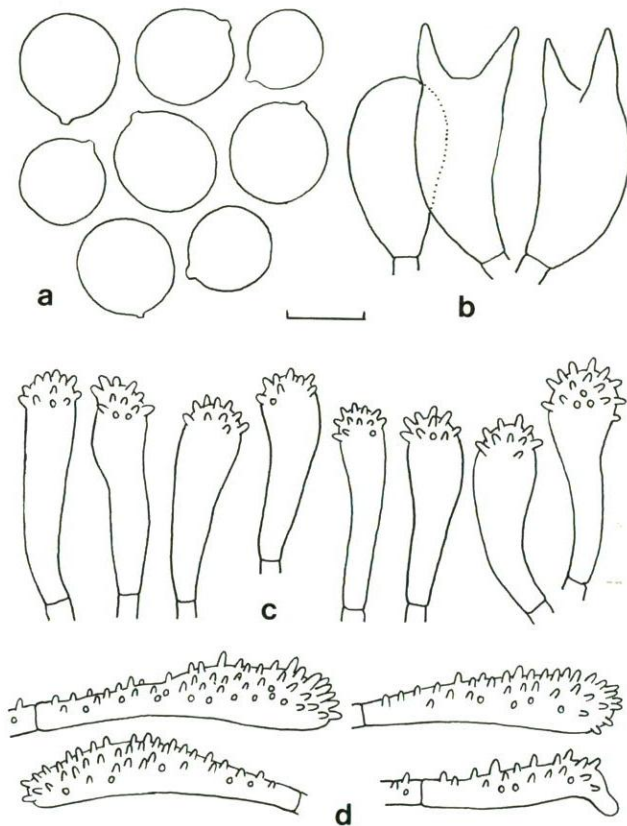


FIG. 13. *Mycena* aff. *abieticola* (SP 380282). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis terminal cells. Bar = 10 μ m.

walled; spinulae $1\text{--}2.5 \times 0.5\text{--}1$ μ m, rod-like, obtuse, hyaline. *Pleurocystidia* absent. *Subhymenium* nongelatinous. *Lamellar trama* regular, dextrinoid. *Pileipellis* a cutis of repent, hyphae $3\text{--}10$ μ m diam, cylindrical to inflated, densely spinulose, hyaline, inamyloid to weakly dextrinoid, nongelatinous; *terminal cells* (FIG. 13d) $24\text{--}45 \times 4.5\text{--}9.5$ μ m, repent, subclavate to clavate, densely spinulose over the outer surface, hyaline; spinulae $1\text{--}3 \times 0.5\text{--}1$ μ m, rod-like, obtuse, unevenly distributed. *Hypodermium* of inflated hyphae up to 20 μ m diam, fusoid to ovoid, hyaline, dextrinoid, nongelatinous, thin-walled. *Pileus trama* interwoven, composed of hyphae $3\text{--}12$ μ m diam, cylindrical, hyaline, dextrinoid, nongelatinous, thin-walled. *Stipitipellis* a cutis; *cortical hyphae* $3\text{--}8$ μ m diam, cylindrical, densely spinulose like the pileipellis hyphae, hyaline, inamyloid, nongelatinous, thin-walled; *medullary hyphae* $3\text{--}10$ μ m diam, cylindrical, smooth, hyaline, dextrinoid, nongelatinous, thin-walled. *Caulocystidia* absent. *Clamp connections* absent in all tissues.

Habit, habitat and known distribution. Solitary on bark of dead undetermined dicotyledonous tree. São Paulo state, Brazil.

Material examined. BRAZIL. São Paulo state, Mun. Iporanga, Parque Estadual Turístico do Alto Ribeira, Poço do Vead, Poço da Viúva, 26 Mar 2006, C.V. Stevani 26.03.06.02 (SP 380282).

Commentary. The specimen described above was erroneously reported as *Mycena fera* Maas Geest. & de Meijer by Desjardin et al. (2007). DNA sequences of this specimen obtained as part of our project on the phylogeny of *Mycena sensu lato* (Desjardin and Perry unpubl) indicated that the specimen was not conspecific with *M. fera* and warranted closer scrutiny. Re-examination of the material indeed indicated that it did not represent *M. fera* but was most phenetically similar to *M. abieticola* Singer, a species described from Mexico growing on the bark of *Abies religiosa* and not reported to be luminescent. The Brazilian specimen matches *M. abieticola* in macromorphology, basidiospore size, 2-spored basidia, cheilocystidia size, absence of clamp connections, and spinulose, nongelatinous pileipellis and stipitipellis hyphae. However *M. abieticola* forms a minutely pilose pileus with pileocystidia 70×3 μ m, a pruinose stipe with fascicles of hair-like caulocystidia, longer spinulae (< 12 μ m), and grows on bark of *Abies* (fide Singer 1973). The Brazilian specimen forms glabrous pilei and stipes lacking cystidia, has spinulae only up to 3 μ m long, and grows on bark of an undetermined dicotyledonous tree. Because the specimen consists of only a few basidiomes that lack detailed macromorphological notes we are hesitant to describe it as a new species. *Mycena fera*, although macromorphologically similar, bioluminescent and present at the same site, differs in forming smaller basidiospores (mean range $10.3\text{--}10.6 \times 10.1\text{--}10.3$ μ m), 4-spored basidia, cheilocystidia with 3–6 apical appendages $5\text{--}22 \times 2.5\text{--}4.5$ μ m, coarser spinulae ($5\text{--}20 \times 1\text{--}4$ μ m) on pileipellis and stipitipellis hyphae, and clamp connections in all tissues (Desjardin et al. 2007).

Mycena aspratilis Maas Geest. & de Meijer, Verh. Kon. Ned. Acad. Wetensch., Afd. Natuurk., Tweede Reeks 97:44. 1997. (FIG. 4)

An excellent, comprehensive description and illustrations are provided in the protologue (Maas Geesteranus and de Meijer 1997). To those data we add the following.

Luminescence. Hymenophore emitting a bright, greenish-yellow light; other parts of the basidiome nonluminescent.

Habit, habitat and known distribution. Scattered on small twigs (Puerto Rico) or leaves (Brazil) of dead undetermined dicotyledonous trees. Paraná state, Brazil, Puerto Rico.

Material examined. PUERTO RICO. El Yunque

National Forest, Wilderness Area, El Toro Trail, N18°17'0", W65°51'15", 650 m, 20 Feb 2009, collected by S.A. Cantrell, D.J. Lodge and L. Millman, PR-6539 (SFSU).

Commentary. *Mycena aspratilis* is reminiscent of a *Roridomyces* species in the field, characterized by a glabrous, striate, centrally depressed pileus, long-decurrent lamellae, and thickly gelatinous stipe surface. However the presence of thick-walled ($< 3 \mu\text{m}$), spinulose and long-pedicellate cheilocystidia and pleurocystidia indicate a unique taxonomic position within *Mycena*. Maas Geesteranus and de Meijer (1997) erected the monotypic sect. *Aspratiles* to accommodate this unusual species and suggested that it might be allied with sect. *Polyadelphia* Singer ex Maas Geest. Desjardin and Braga-Neto (2007) suggested that *M. lacrimans* Singer, a putatively rare luminescent species from Amazonia, Brazil, might be a second member of sect. *Aspratiles*, although *M. lacrimans* forms a nongelatinous stipe and has thin-walled hymenial cystidia. We report for the first time that the lamellae of *M. aspratilis* emit a strong greenish-yellow light, and we extend the known distribution of the species northward from southern Brazil to Puerto Rico.

Mycena margarita (Murr.) Murr., Mycologia 8:220. 1916. (FIGS. 7, 14)

Synonyms:

- = *Prunulus margarita* Murr., N. Amer. Flora 9:340. 1916.
- = *Prunulus subepipterygius* Murr., Bull. Torrey Bot. Club 67:233. 1940.
- = *Mycena subepipterygia* (Murr.) Murr., Bull. Torrey Bot. Club 67:235. 1940.

Possible synonym:

- = *Mycena chlorinosma* Singer, Revue Mycol. 2:232. 1937.

Pileus (FIG. 7) (8–)10–18 mm diam, when young conical to parabolic, becoming convex-hemispherical, then broadly convex with a low flattened umbo that becomes slightly depressed in the center at maturity, pellucid-striate to striate or sulcate, glabrous, shiny, pearly opalescent, subviscid to viscid; Hair Brown to Sayal Brown or Drab on the disc, radially streaked with Light Drab striae, nearly white on the margin. **Lamellae** adnexed, subdistant to distant with two series of lamellulae, moderately broad (~ 2 mm), white, nonmarginate. **Stipe** 10–20 \times 1–2 (~ 3) mm, central, terete, cylindrical, equal, hollow, arising from a cupulate basal disc with internal radial fibrils (not regularly striate); surface dry, pruinose overall, white at the apex grading to Drab Gray at the base, some staining Yellowish Buff at the base. **Odor** strongly of chlorine, or weakly of chlorine or not distinctive in some populations; **taste** distinct but unidentifiable.

Luminescence. yellowish green light in all parts of

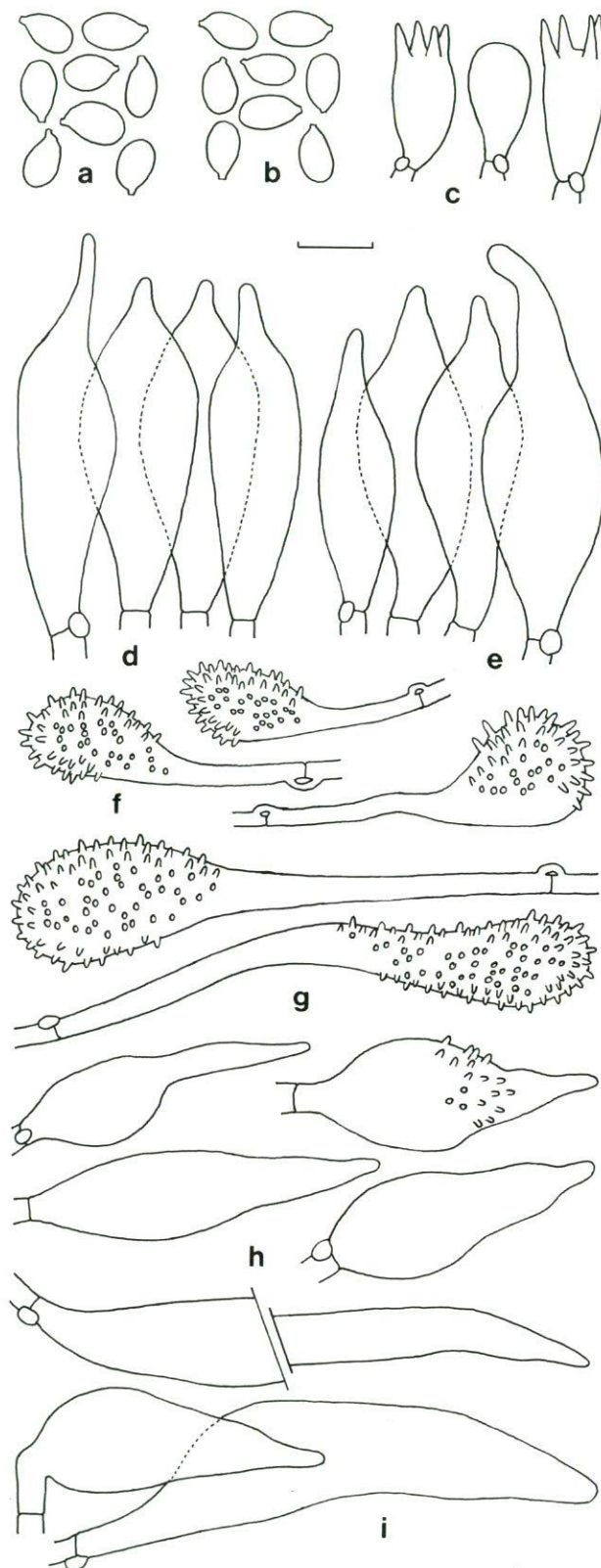


FIG. 14. *Mycena margarita*. a–b. Basidiospores. c. Basidia and basidiole. d–e. Cheilocystidia. f–g. Pileipellis terminal cells. h. Pileus marginal cells. i. Caulocystidia. (a, d, f. HOLOTYPE of *Prunulus margarita*; b, e, g. PR-5447; c, i. PR-3292; h. BZ-4303). Bar = 10 μm .

the basidiome, or nonluminescent in some populations.

Basidiospores (FIG. 14a–b) $6\text{--}8.5 \times 4\text{--}5\text{--}(5.5) \mu\text{m}$ [$x_{\text{mr}} = 6.3\text{--}7.6 \times 4.1\text{--}4.8 \mu\text{m}$, $x_{\text{mm}} = 6.9 \pm 0.5 \times 4.4 \pm 0.3 \mu\text{m}$, $Q = 1.3\text{--}1.8$, $Q_{\text{mr}} = 1.5\text{--}1.7$, $Q_{\text{mm}} = 1.57 \pm 0.07$, $n = 15\text{--}40$, $s = 6$], ellipsoid, smooth, hyaline, amyloid, thin-walled. *Basidia* (FIG. 14c) $14.5\text{--}19 \times 7.5\text{--}9.5 \mu\text{m}$, clavate, 4-spored, clamped. *Basidioles* clavate. *Lamellar edge* mostly sterile, nongelatinized; *cheilocystidia* (FIG. 14d–e) abundant, $30\text{--}60 \times (6.5\text{--})9\text{--}18\text{--}(24) \mu\text{m}$, fusoid-ventricose to broadly clavate-rostrate, rostrum narrowly conical and simple or rarely forked, smooth, hyaline, inamyloid, thin-walled. *Pleurocystidia* absent. *Subhymenium* nongelatinous to gelatinous. *Lamellar trama* regular, composed of inflated, short-celled hyphae up to $32 \mu\text{m}$ diam, dextrinoid, thin-walled, nongelatinous. *Pileipellis* an ixocutis up to $200 \mu\text{m}$ thick composed of repent, radially aligned, widely spaced hyphae with repent to suberect terminal cells; hyphae $1.5\text{--}5 \mu\text{m}$ diam, cylindrical, branched, smooth or sparsely spinulose, hyaline, inamyloid, thin-walled, with normal or loop-like clamp connections, interspersed with narrower hyphae ($1\text{--}2 \mu\text{m}$ diam) with numerous needle-like outgrowths $2\text{--}10 \times 0.5\text{--}1 \mu\text{m}$; *terminal cells* (FIG. 14f–g) $22\text{--}48\text{--}(75) \times (5\text{--})8\text{--}13 \mu\text{m}$, subcylindrical to clavate, often long-pedicellate, densely spinulose, hyaline, inamyloid, thin-walled; hyphae and terminal cells embedded in a gelatinous matrix; spinulae $1.0\text{--}3.5 \times 0.5\text{--}1.2 \mu\text{m}$, cylindrical (rod-like), obtuse, unevenly distributed. *Pileus marginal cells* (FIG. 14h) abundant, $22\text{--}48 \times 7\text{--}16 \mu\text{m}$, similar to the cheilocystidia, smooth or sparsely spinulose, apex narrowly conical and acute, not forked. *Hypodermium* of inflated, short- to long-celled hyphae ($8\text{--}12\text{--}24\text{--}(32) \mu\text{m}$ diam, hyaline, strongly dextrinoid, nongelatinous, thin-walled. *Pileus trama* interwoven, hyphae $4\text{--}12 \mu\text{m}$ diam, cylindrical to inflated, hyaline, dextrinoid, nongelatinous, thin-walled. *Stipitipellis* a cutis of repent hyphae plus scattered to clustered caulocystidia; *cortical hyphae* $3\text{--}8 \mu\text{m}$ diam, parallel, cylindrical, smooth, hyaline, inamyloid to weakly dextrinoid, nongelatinous to subgelatinous, thin-walled; *medullary hyphae* $6.5\text{--}24 \mu\text{m}$ diam, cylindrical to inflated, hyaline, strongly dextrinoid, nongelatinous, thin-walled; *caulocystidia* (FIG. 14i) $(35\text{--})60\text{--}110\text{--}(150) \times 8\text{--}16\text{--}(18) \mu\text{m}$, fusoid to lanceolate, hyaline, inamyloid, nongelatinous, thin-walled. *Basal cup* composed of parallel hyphae ($2.5\text{--}3.5\text{--}10 \mu\text{m}$ diam, cylindrical, smooth, hyaline, inamyloid to weakly dextrinoid, nongelatinous, thick-walled ($0.5\text{--}1.5 \mu\text{m}$); internal radial fibrils of hyphae $2.5\text{--}5 \mu\text{m}$ diam, cylindrical, smooth, hyaline, inamyloid, nongelatinous, thick-walled ($0.5\text{--}1 \mu\text{m}$); terminal cells undifferentiated or subcylindrical to subclavate,

broadly obtuse, smooth. *Clamp connections* common in all tissues.

Habit, habitat and known distribution. Solitary or gregarious on rotten logs. Belize, Dominican Republic, Jamaica, Puerto Rico, United States (Florida).

Material examined. BELIZE. Stann Creek Dist., Doyle's Delight, north trail along stream bank, 22 Aug 2007, collected by C. Young, ledger D.J. Lodge, #BZ-4303 (SFSU). DOMINICAN REPUBLIC. Prov. Santiago, Parque Armando Bermúdez, Anton Sape Bueno, N19°12'7.4", W70°59', 980 m, 11 Jan 2003, collected by E. Grand, ledger D.J. Lodge, #DR-2652 (SFSU). JAMAICA. Morce's Gap, 5000 ft., very wet mountainous region, tree ferns and filmy ferns in abundance, 29, 30 Dec, 2 Jan 1908–1909, W.A. and Edna Merrill, (HOLOTYPE of *M. margarita* NY). PUERTO RICO. Cordillero Central, Mun. de Maricao, Maricao Community Forest, behind fish hatchery, N18°11'32", W66°59'36", 400 m, 25 Jun 1996, collected by E. Horak, #PR-3292 (ZT) and D.J. Lodge and T.J. Baroni #PR-3293 (SFSU); Sierra de Cayey, Mun. Patillas, Carite Commonwealth Forest, Charco Azul, 1 Aug 1998, collected by S.A. Cantrell, #PR-5447 (SFSU).

Analysis of the holotype specimen.—The material consists of one-half of one pileus with badly fragmented lamellae, few with intact edges, plus one stipe cut in half; all in poor condition. As dried: *Pileus* 5 mm diam, plano-convex (no apparent umbo), striate, cream colored, with adherent debris suggesting originally viscid. *Lamellae* subfree, lacking a pseudocollarium, subdistant, broad, off-white, nonmarginate. *Stipe* $9 \times 0.5 \text{ mm}$, cylindrical, glabrous, pale brown, arising from a distinct cup-shaped basal disc.

Basidiospores (FIG. 14a) $6.7\text{--}8.5 \times 4.3\text{--}5.5 \mu\text{m}$ [$x_{\text{m}} = 7.6 \pm 0.5 \times 4.7 \pm 0.2 \mu\text{m}$, $Q = 1.4\text{--}1.8$, $Q_{\text{m}} = 1.64 \pm 0.07$, $n = 25$], broadly ellipsoid, smooth, hyaline, weakly amyloid, thin-walled. *Basidia* not observed. *Basidioles* clavate. *Cheilocystidia* (FIG. 14d) abundant, lamellar edge mostly sterile, $37\text{--}54 \times 12.5\text{--}18 \mu\text{m}$, fusoid-ventricose to broadly clavate-mucronate, simple (nonspinulose), hyaline, inamyloid, thin-walled, nongelatinous. *Pleurocystidia* absent. *Lamellar trama* dextrinoid. *Pileipellis* an ixocutis of hyphae embedded in a thick gelatinous matrix; hyphae difficult to differentiate, narrow ($1.5\text{--}5 \mu\text{m}$), smooth for most of their length, inamyloid; *terminal cells* (FIG. 14f) inflated to clavate, up to $12 \mu\text{m}$ diam, long-pedicellate, with scattered spinulae; spinulae $1\text{--}2 \times 0.5 \mu\text{m}$, cylindrical, unevenly distributed; spinulate cells interspersed with narrow hyphae with spine-like outgrowths. *Pileus trama* dextrinoid, nongelatinous; no hypodermium observed, material poorly reviving.

Stipitipellis a cutis; cortical hyphae 3–6 μm diam, cylindrical, smooth, hyaline, weakly dextrinoid, nongelatinous, thin-walled; medullary hyphae 5–12 (–18) μm , dextrinoid, otherwise similar to cortical hyphae. *Caulocystidia* scattered, fusoid-ventricose, simple, similar to the cheilocystidia. *Clamp connections* present.

Commentary. The protologue of *Prunulus margarita* described a single basidiome with convex-umbonate pileus, lamellae attached to a collarium, a cylindrical stipe, with no mention of odor. Examination of the holotype specimen revealed a convex pileus lacking an umbo (at least when dried), subfree lamellae lacking a collarium, and a stipe that arises from a cup-like basal disc. All latter features are diagnostic of the fresh material herein recognized as *M. margarita*. The shape of the pileus in Puerto Rico populations was found to change with age and included a low umbonate stage during early expansion. Murrill (1916) did not report an odor, although he seldom reported odors in his descriptions, but the collection from Belize clearly lacked an odor, suggesting this might be a variable character. Smith (1947) studied the holotype specimen of *P. margarita* and documented a few micromorphological features congruent with our findings, although he reported the basidiospores as slightly broader. Of diagnostic significance were basidiospores $7\text{--}8 \times 5\text{--}6 \mu\text{m}$ ($4.3\text{--}5.5 \mu\text{m}$ diam in our analysis), a gelatinized pileipellis 150–200 μm thick, nongelatinous lamellar edges formed from broadly fusoid-ventricose cheilocystidia 12–20 μm broad, and a nongelatinous stipitipellis. Dennis (1951) described and illustrated (PL. 23, FIG. 10) specimens from Trinidad and Venezuela that he identified as *M. margarita* that strongly resemble ours. Although Dennis reported basidiospores narrower ($3.5\text{--}4 \mu\text{m}$ diam) than those reported by Smith (1947), DJL measured basidiospores of RWG Dennis #357 from Venezuela ($4.6\text{--}5.5 \mu\text{m}$ diam) and found that they fell within the range of our collections and Smith's type study. The Venezuelan collection however differed in having a strongly lamellate basal disc and a narrower (14 μm) isolattice on the pileus, suggesting that it might not represent *M. margarita*. Pegler (1983) provided a description of the species that he reported as common in Guadeloupe, Dominica and Trinidad, that differs only in his observation that the pileipellis is formed from narrow hyphae 1–3 μm diam (no mention whether they were smooth or spinulose). No published accounts report the species as luminescent.

We accept *M. subbeipterygia* (Murr.) Murr. as a synonym of *M. margarita* and *M. chlorinosma* Singer as a possible synonym. Maas Geesteranus (1989) provided details and illustrations of the micromorphology of the holotype specimen of *Prunulus subbeipterygius*

collected at Planera Hammock, Florida, and his data are of sufficient quality that we did not need to re-examine the limited material in the holotype specimen at FLAS. He listed *M. subbeipterygia* as a tentative synonym of *M. chlorinosma*, described from material collected in a greenhouse in Leningrad, but noted a few differences between the species. Repeated requests to LE to study the holotype specimen of *M. chlorinosma* went unanswered. *Mycena chlorinosma* was reported by Singer (1937) to have a dry stipe and a strong odor of chlorine, and Maas Geesteranus (1989) observed smooth pileipellis hyphae and no terminal cells on the holotype specimen. In comparison *M. subbeipterygia* was reported by Murrill (1940) to have a viscid stipe, no odor was reported, and Maas Geesteranus (1989) observed spinulae on the pileipellis hyphae and terminal cells. A specimen from Monteverde, Costa Rica (#B-14427) determined by Singer as *M. chlorinosma* and accompanied with notes on macro- and micromorphology (deposited in F) suggests a species identical to our material described above, although Singer provided no details of pileipellis anatomy stating "epicutis little developed." Indeed Singer annotated the holotype specimen of *P. subbeipterygius* as *M. chlorinosma*.

Morphologically our specimens share features with both *M. chlorinosma* and *M. subbeipterygia*. Like *M. chlorinosma* our material has a dry stipe and usually a strong chlorine odor but matches *M. subbeipterygia* in having spinulose pileipellis hyphae and terminal cells. Smith (1947) published a type study of *P. subbeipterygius* and provided some details in disagreement with the latter type study of Maas Geesteranus (1989). For example Smith noted inamyloid basidiospores and a gelatinous stipitipellis and subhymenium whereas Maas Geesteranus reported amyloid basidiospores, illustrated subgelatinous stipitipellis hyphae and did not comment on the subhymenium. Because the micromorphological features of our material closely match those from the holotype of *P. margarita* (the oldest epithet) and match the holotype of *P. subbeipterygius* as reported and illustrated by Maas Geesteranus (1989), we accept our material as representing *M. margarita* with *M. subbeipterygia* as a synonym. Our circumscription broadens the circumscription of *M. margarita* to include a dry to subviscid stipe (i.e. nongelatinous to subgelatinous stipitipellis), a usually strong odor of chlorine, a pigmented stipe base arising from a cupulate basal disc and bioluminescent properties.

Basidiospores from the holotype specimen are slightly larger ($x_m = 7.6 \times 4.8 \mu\text{m}$; $Q_m = 1.6$) than those from all other specimens examined, although the shape is identical: e.g. $x_m = 6.3 \times 4.3 \mu\text{m}$, $Q_m = 1.5$ from Belize (#BZ-4303); $x_m = 6.7 \times 4.2 \mu\text{m}$, Q_m

= 1.6 from Dominican Republic (#DR-2652); $x_m = 7.4 \times 4.5 \mu\text{m}$, $Q_m = 1.6$ from Puerto Rico (#PR-5447). The specimens from Belize, Dominican Republic and Puerto Rico have identical nLSU and mtSSU sequences (unpubl data), although there is some variability in micromorphology, odor and luminescence. The Belize specimen forms broadly clavate-rostrate cheilocystidia, distinctly gelatinous subhymenial tissue, has a stipe surface described as slightly viscid, although the stipitipellis is nongelatinous to subgelatinous, and the basidiomes were reported as nonluminescent. The Puerto Rico specimens have consistently fusoid-ventricose cheilocystidia, nongelatinous subhymenial and stipitipellis tissues, and the basidiomes are luminescent, whereas the Dominican Republic specimen has micromorphology indistinguishable from the Puerto Rican specimens, but unfortunately the luminescent properties were not recorded. Because the molecular data are invariable among the specimens we consider them all to represent the same species. As in *Panellus stipticus*, this species may have luminescent and nonluminescent populations, or luminescence in the Belize specimens was so weak it was not easily observed by the naked eye.

Murrill (1916) and Smith (1947) did not place *M. margarita* in any infrageneric group, whereas Pegler (1983) included the species in sect. *Fragilipedes*. Maas Geesteranus (1992) established sect. *Ingratae* Maas Geest. with *M. chlorinosma* as type species and stirps *Subbeipterygia* A.H. Sm. (type species: *M. subbeipterygia*) as a synonym. Although he refrained from formally accepting *M. subbeipterygia* as a synonym of *M. chlorinosma* he implicitly recognized both epithets as belonging to his sect. *Ingratae*. A careful comparison of the circumscriptions of sect. *Ingratae* and sect. *Exornatae* (Maas Geesteranus 1982b; type species, *Hiatula boninensis* Berk. & M.A. Curtis, accepted as a synonym of *M. chlorophos*; cf. Maas Geesteranus 1992) reveal that the only difference is loop-like clamp connections on the pileipellis hyphae in sect. *Ingratae* and normal clamp connections in sect. *Exornatae*. Indeed *M. margarita* is strongly suggestive of *M. chlorophos*, and we had at first identified our material as representing the latter species, especially because *M. chlorophos* is strongly luminescent. Even Maas Geesteranus and de Meijer (1997:140) recognized the similarities when they suggested, "It is plausible, therefore, that the viscid-stemmed *M. subbeipterygia*, found in Florida, is just another name of this wide-spread species" (viz. *M. chlorophos*). Loop-like clamp connections are found in a number of *Mycena* species spread among different infrageneric groups, and we do not accept the character as sufficiently

significant to distinguish sections. We therefore accept *M. margarita* as a member of sect. *Exornatae* where it is closely allied with *M. chlorophos*, thus reducing sect. *Ingratae* to synonymy with sect. *Exornatae*.

Mycena chlorophos (Berk. & M.A. Curtis) Sacc. was described in 1860 from material collected by Charles Wright in the Bonin Islands, Japan, as part of the U.S. North Pacific Exploring Expedition (1853–1856) under Commanders Ringgold and Rodgers (cf. Pfister 1978). The species has been reported in the Old World from as far north as Hachijo Island, Japan, (Corner 1954) and southward to Sri Lanka (Pegler 1986), peninsular Malaysia (Corner 1954, 1994), Borneo (Sabah, Maas Geesteranus 1992), Micronesia (Ito and Imai 1939, Corner 1954), Papua New Guinea (Horak and Kobayasi 1978, Maas Geesteranus and Horak 1995), and Australia, in field guides such as Aberdeen (1979), Shepherd and Totterdell (1988), Young (1982). In the New World the species has been reported from Brazil (Manaus and Rio de Janeiro, Corner 1954; Paraná, Maas Geesteranus and de Meijer 1997). Based on these reports the species is currently recognized as pantropical. Early descriptions of specimens from the Bonin Islands provided few micromorphological details. At best data were provided on basidiospores and cheilocystidia. For example Ito and Imai (1939) and Hongo (1977) reported the basidiospores as $6-8 \times 4-6 \mu\text{m}$ and $6.5-9 \times 4.5-6 \mu\text{m}$ respectively and the cheilocystidia as $35-66 \times 10-22$, broadly fusoid to ventricose with the apex drawn out to a point (Hongo 1977). Only Maas Geesteranus (1982a) provided a relatively detailed micromorphological analysis based on a type study of the poorly preserved lectotype at K (mistakenly reported by Maas Geesteranus as holotype). More detailed micromorphological analyses reported by Corner (1954, 1994), Pegler (1986), Maas Geesteranus (1992) and Maas Geesteranus and de Meijer (1997) were based respectively on specimens from peninsular Malaysia, Sri Lanka, Borneo and Brazil. No comprehensive study of the micromorphological characters of good quality topotypical material has yet been published. To stabilize the epithet, allow for accurate comparisons of New World and Old World specimens commonly referred to *M. chlorophos* and to help determine whether the species is pantropical or represents several geographically isolated distinct species, we provide data from topotypical material, including analyses of an isoelectotype specimen of *Agaricus chlorophos* (FH), an isoelectotype of *Agaricus cyanophos* (FH), and recently collected and cultured material from the Bonin Islands. In addition we designate an epitype specimen (affixed to the lectotype at K) of *M. chlorophos*.

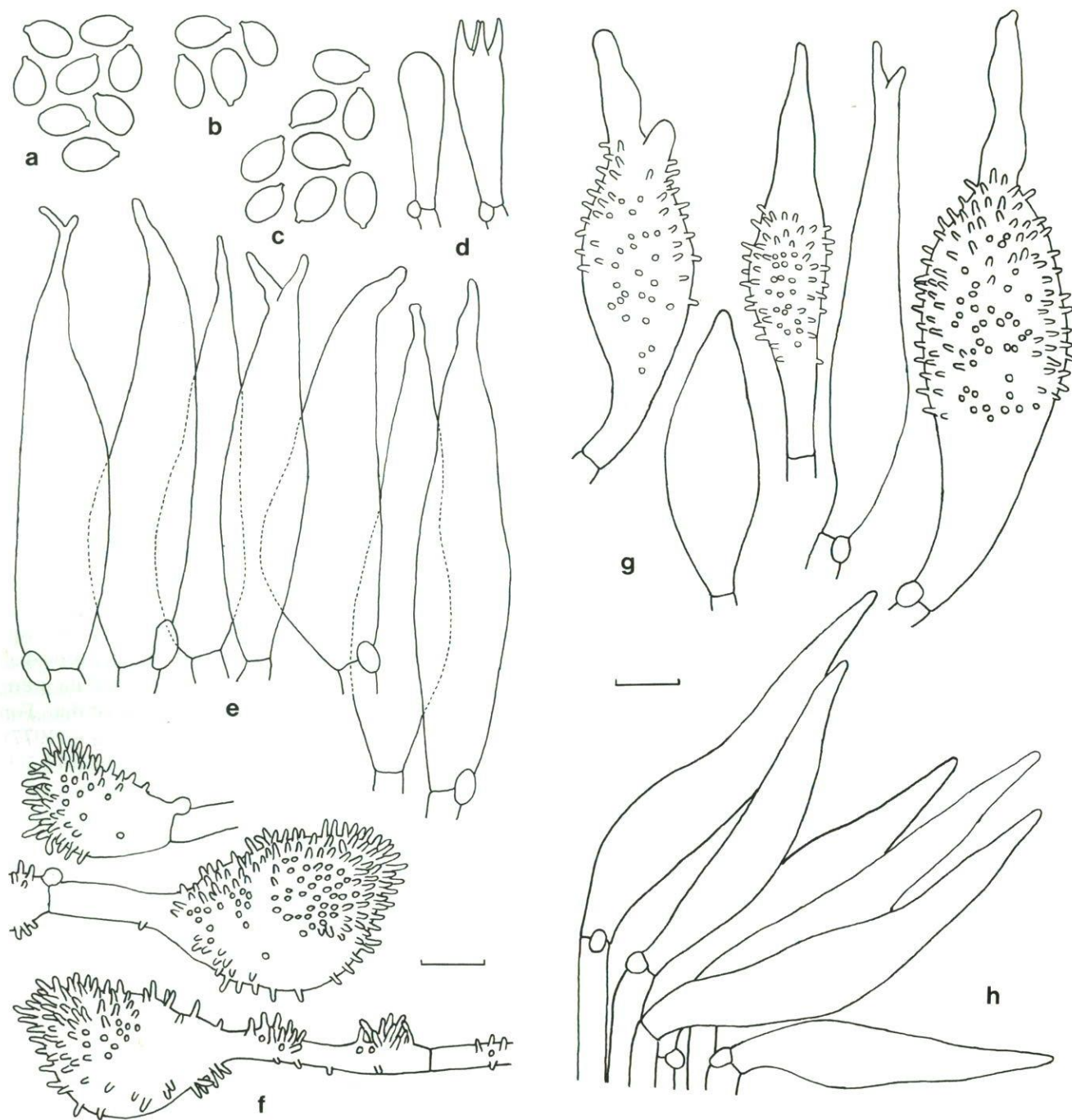


FIG. 15. *Mycena chlorophos*. a-c. Basidiospores (a. ISOTYPE of *Agaricus chlorophos*; b. ISOTYPE of *Agaricus cyanophos*; c. EPITYPE). d. Basidium and basidiole. e. Cheilocystidia. f. Pileipellis terminal cells. g. Pileus marginal cells. h. Caulocystidia. (d-h. Nagasawa 06-379). Bar = 10 μ m.

Mycena chlorophos (Berk. & M.A. Curtis) Sacc., Syllog. Fung. 5:301. 1887. (FIGS. 8, 15)

Basionym: *Agaricus chlorophos* Berk. & M.A. Curtis, Proc. Amer. Acad. Arts Sci. 4:113. 1860. Lectotype designated here, Japan, Bonin Islands, on hillside on dead logs, 21 Oct 1854 (K). For an analysis of this specimen see Maas Geesteranus (1982a).

Isolectotype study of Agaricus chlorophos based on material at FH.—The material consists of four basidiomes pressed flat and glued to paper, each covered with a fibrous layer of thin paper and infected with molds. One dried pileus 25 mm diam; lamellae subdistant, narrow, nearly free. One dried and flattened stipe 18 \times 2 mm. Material too poor for

a comprehensive micromorphological analysis, but a few details were retrieved as follows. *Basidiospores* (FIG. 15a) $7.0\text{--}9.0 \times 5.0\text{--}6.0 \mu\text{m}$ [$x_m = 7.9 \pm 0.4 \times 5.5 \pm 0.3 \mu\text{m}$, $Q = 1.3\text{--}1.6$, $Q_m = 1.5 \pm 0.11$, $n = 20$], broadly ellipsoid, smooth, hyaline, amyloid, thin-walled. *Basidia* 4-spored. *Basidioles* clavate. *Pleurocystidia* absent. *Lamellar trama* dextrinoid. *Clamp connections* present. Other data unretrievable.

Berkeley and Curtis (1860) described *Agaricus cyanophos* Berk. & M.A. Curtis based on material collected from near the same site 2 wk later and distinguished the two species on pileus shape, lamellar attachment and color of emitted light. *Agaricus chlorophos* had a convex-depressed pileus, slightly decurrent lamellae and emitted green light, whereas *A. cyanophos* had a campanulate pileus, free lamellae and emitted pale blue light. Ito and Imai (1939) studied a large number of specimens collected from the Bonin Islands and grown in culture, and they reported that they were variable in shape and lamellar attachment. Accordingly they accepted the two as conspecific and accepted the epithet *Mycena chlorophos* to represent the species. Maas Geesteranus (1982a) reported that the holotype specimen of *A. cyanophos* was absent from K. We located a syntype specimen of *A. cyanophos* at FH and herein designate it as the lectotype. A type study of this specimen is presented here.

Lectotype study of Agaricus cyanophos based on material at FH.—Japan, Bonin Islands, on decayed wood in shady ravines, 1 Nov 1854 (LECTOTYPE designated here). The lectotype specimen consists of three basidiomes pressed flat between scraps of loose paper, in poor condition. As dried: *Pileus* 12–20 mm diam, striate. *Lamellae* free, subdistant with two series of lamellulae. *Stipe* 10–15 \times 1.5 mm, pruinose at the apex, noninsititious. Material too poor for a comprehensive micromorphological analysis. Only data on basidiospores was retrievable. *Basidiospores* (FIG. 15b) $7.5\text{--}8.5 \times 5.0\text{--}5.5 \mu\text{m}$ [$x_m = 8.0 \pm 0.4 \times 5.3 \pm 0.2 \mu\text{m}$, $Q = 1.5\text{--}1.6$, $Q_m = 1.5 \pm 0.06$, $n = 6$], broadly ellipsoid, smooth, hyaline, amyloid, thin-walled.

Although few details were recoverable from the lectotype specimen, we concur with Ito and Imai (1939) and accept *A. cyanophos* as a synonym of *A. chlorophos*.

Description of topotypical material of Mycena chlorophos.—*Pileus* (FIG. 8) 10–27 mm diam, obtusely conical to campanulate when young, expanding in age to broadly convex or plano-convex, with a small umbo or centrally depressed, striate to rugulose-striate or sulcate, margin crenulate, viscid when moist, white-pruinose overall; disc light yellowish brown or

yellowish brown (Tawny Olive to Isabella Color; 5D-E4-7) to grayish brown (Hair Brown to Snuff Brown; 6D-E3-4), paler to the nearly white margin. *Lamellae* narrowly adnexed to free, close to subdistant with two series of lamellulae, sometimes intervenose, broad (< 3 mm), white, nonmarginate. *Stipe* 15–25 \times 1–2(–3) mm, central, terete or compressed and once-cleft, equal above the basal disc, pliant, hollow, dull, dry, white-pruinose overall, white to grayish white overall or with a white apex and grading downward to brown (6E8) at the base; basal disc 3–5 mm diam, cushion-shaped, striate, brownish yellow (5C7). *Odor* strongly nitrous-like or of chlorine.

Luminescence. Pileus and lamellae strongly luminescent, stipe weakly luminescent, emitting yellowish green light. Mycelium luminescent in culture.

Basidiospores (FIG. 15c) $(6.8\text{--})7.0\text{--}9.0 \times (4.8\text{--})5.0\text{--}6.0 \mu\text{m}$ [$x_{mr} = 7.7\text{--}8.0 \times 5.3\text{--}5.5 \mu\text{m}$, $x_{mm} = 7.8 \pm 0.1 \times 5.4 \pm 0.1 \mu\text{m}$, $Q = 1.3\text{--}1.6$, $Q_{mr} = 1.4\text{--}1.5$, $Q_{mm} = 1.46 \pm 0.06$, $n = 20\text{--}25$, $s = 6$], broadly ellipsoid, smooth, hyaline, amyloid, thin-walled. *Basidia* (FIG. 15d) $22\text{--}30 \times 7.5\text{--}8.5 \mu\text{m}$, clavate, 4-spored, clamped. *Basidioles* clavate. *Lamellar edge* fertile but mostly sterile; *cheilocystidia* (FIG. 15e) abundant, $44\text{--}100 \times (9.5\text{--})11\text{--}22 \mu\text{m}$ (shorter and narrower ones nearest the stipe, longer and broader ones nearest the pileus margin), fusoid to fusoid-ventricose, apically narrowed to an acute tip, cells near pileus margin with tip often long and narrow ($4\text{--}22 \times 1.5\text{--}4 \mu\text{m}$), often strangulate and sometimes bifid, hyaline, inamyloid, nongelatinous, thin-walled. *Pleurocystidia* absent. *Subhymenium* nongelatinous. *Lamellar trama* regular, composed of dextrinoid hyphae. *Pileipellis* an ixocutis up to $80 \mu\text{m}$ thick composed of loosely interwoven to radially aligned, repent hyphae with repent to suberect terminal cells; hyphae $2\text{--}6.5 \mu\text{m}$ diam, cylindrical, smooth or sparsely spinulose, hyaline, inamyloid; *terminal cells* (FIG. 15f) $10\text{--}50$ (–65) \times $(5\text{--})10\text{--}25 \mu\text{m}$, clavate to broadly clavate, densely spinulose, hyaline, inamyloid, thin-walled; hyphae and terminal cells embedded in a thin gelatinous matrix; spinulae $1.5\text{--}4$ (–6) \times $0.5\text{--}2 \mu\text{m}$, cylindrical to rod-like, obtuse, unevenly distributed. *Pileus marginal cells* (FIG. 15g) abundant, $44\text{--}100 \times 12.5\text{--}23 \mu\text{m}$, fusoid to fusoid-ventricose, apex acute or obtuse, often bifid, mostly with sparse spinulae over the central portion, seldom entirely smooth, apex always smooth, hyaline, inamyloid, thin-walled. *Hypodermium* a mixture of cylindrical, much-branched hyphae $3\text{--}8 \mu\text{m}$ diam and inflated, vesiculose to fusoid cells up to $22 \mu\text{m}$ diam, hyaline, strongly dextrinoid, nongelatinous, thin-walled. *Pileus trama* hyphae $3\text{--}8 \mu\text{m}$ diam, subparallel, radially arranged, cylindrical, smooth, hyaline to pale yellowish gray, dextrinoid, nongelatinous, thin-walled. *Stipitipellis* a cutis of

repent hyphae plus scattered to clustered caulocystidia; *cortical hyphae* 3–10 µm diam, parallel, cylindrical, smooth, hyaline, dextrinoid, nongelatinous, thin-walled; *medullary hyphae* 10–28 µm diam, cylindrical, hyaline, dextrinoid, nongelatinous, thin-walled; *caulocystidia* (FIG. 15h) 72–116 × 12–20 µm, fusoid to fusoid-ventricose, hyaline, inamyloid, thin-walled. *Clamp connections* common in all tissues.

Habit and habitat. Gregarious on fallen branches, logs and trunks.

Material examined. JAPAN. Bonin Islands, Hahajima, Ogasawara, Igumadani, 30 Oct 2005, *H. Neda* (TFM-M-M512). The following six specimens were cultivated in the laboratory of the Tottori Mycological Institute, Tottori City, Kokoge, from inoculum isolated from TFM-M-M512: cultivated on organic medium (peat moss + rice bran), 19 Oct 2006, *E. Nagasawa* 06-356 (EPITYPE designated here affixed to the lectotype of *A. chlorophos* in K: TMI; ISOEPITYPE: SFSU); 30 Oct 2006, *E. Nagasawa* 06-374NRB (TMI); cultivated on organic medium (coconut shells processed for gardening use + peat moss + Ebiosu), 7 Oct 2006, *E. Nagasawa* 06-288 (TMI); 1 Nov 2006, *E. Nagasawa* 06-374NRA2 (TMI); 8 Nov 2006, *E. Nagasawa* 06-379 (TMI); 2 Feb 2007, *E. Nagasawa* 07-0001NR (TMI).

Commentary. The Neda specimen (TFM-M-M512) from Hahajima provided the inoculum from which numerous specimens were grown on organic medium at the Tottori Mycological Institute. The cultivated basidiomes matched field collected specimens and the protologue in all pertinent macro- and micromorphological details. Diagnostic features include: a yellowish brown to grayish brown, campanulate to convex-depressed, striate to sulcate, viscid pileus; adnexed to free, subdistant, broad, white and nonmarginate lamellae; a dry, pruinose stipe arising from a cushion-shaped, striate basal disc; amyloid basidiospores with mean 7.7–8.0 × 5.3–5.5 µm; fusoid-ventricose cheilocystidia 44–100 × 11–22 µm with a narrow, acute and often bifid apical appendage; no pleurocystidia; an ixocutis-type pileipellis with densely spinulose terminal cells and marginal cells like the cheilocystidia except centrally spinulose; dextrinoid trama tissues; and caulocystidia similar to the cheilocystidia that arise from smooth stipe cortical hyphae. It should be noted that measurements of fresh basidiospores obtained from spore prints of basidiomes fruited in culture at different times from the same inoculum differed in mean length by up to 1 µm and in mean width by up to 0.5 µm.

Mycena chlorophos is similar to *M. margarita* and *M. discobasis* Métrod. *Mycena margarita* differs in forming smaller basidiospores (mean 6.9 × 4.4 µm), smaller cheilocystidia (30–60 × 9–18 µm), smaller

pileus marginal cells (22–48 × 7–16 µm) that are mostly smooth, and many loop-like clamp connections. *Mycena discobasis* differs in forming paler pilei (white to grayish white), larger basidiospores (mean 9.9 × 6.7 µm), and the cheilocystidia that lack elongated, often bifid apical appendages characteristic of *M. chlorophos* (Desjardin et al. 2007).

A KEY TO HELP DISTINGUISH THE LUMINESCENT MEMBERS OF SECT. EXORNATAE (*M. MARGARITA*, *M. CHLOROPHOS*, *M. DISCOBASIS* MÉTROD)

1. Basidiospores 8.5–11 × 6–7.5 (mean 9.9 × 6.7) µm; pileus white overall or with a hint of pale gray in the umbilicus *M. discobasis*
1. Basidiospores 6–9 × 4–6 (mean 6.9–7.8 × 4.4–5.4) µm; pileus mostly grayish brown with pallid margin . . . 2
2. Cheilocystidia 44–100 µm long, fusoid to fusoid-ventricose, apically narrowed to an acute tip, those near pileus margin with tip often bifid, long and narrow (4–22 × 1.5–4 µm; pileus marginal cells 44–100 × 12.5–23 µm; basidiospores 7–9 × 5–6 (mean 7.8 × 5.4) µm *M. chlorophos*
2. Cheilocystidia 30–60 µm long, fusoid-ventricose to broadly clavate-rostrate, rostrum short, narrowly conical, those near pileus margin lacking a long, narrow projection; pileus marginal cells 22–48 × 7–16 µm; basidiospores 6–8.5 × 4–5.5 (mean 6.9 × 4.4) µm *M. margarita*

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